

Vol. IX No. 6
June 1985

Unemployment Rate

Seasonally Adjusted
April*

ARIZONA	5.9%
Maricopa Co.	4.5%
Pima Co.	5.5%
UNITED STATES	7.3%

Consumer Price Index

National-March
1967 - Base Year

Wage Earner/Clerical Worker -	315.3
% Chg. Yr. Ago	4.0

All Urban -	318.8
% Chg. Yr. Ago	3.7

Phoenix-1st Qtr. 1985
1977 - Base Year

All Urban -	187.8
% Chg. Yr. Ago	5.9

Producer Price Index

National-April*
1967 - Base Year

All Commodities-	309.3
% Chg. Yr. Ago	-0.7

Finished Goods -	293.1
% Chg. Yr. Ago	0.7

* Preliminary

**UNIVERSITY - INDUSTRY
TECHNOLOGY TRANSFER**

A new type of university-industry relationship has developed in the 1980s that centers around the process of technology transfer from research universities to private firms. One expression of this new, closer relationship is the several university-industry research centers in microelectronics, of which the Microelectronics and Computer Technology Corporation (MCC) in Austin, Texas is a spectacular example. The universities, private companies, and Federal, state, and local governments all seem to benefit from the new university-industry relationships, but important problems may accompany these benefits. The information technologies produced by the microelectronics industry are driving the Information Society.

This paper explores policy issues in the role of government initiatives in the transfer of technology from research universities to private companies. We argue that such technology transfer, especially in the microelectronics industry, is at the heart of the Information Society.

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Nancy Augustin, Editor

We shall pursue five main questions:

1. Why is the research university the key institution in the Information Society?
2. Through what mechanisms, such as research parks, collaborative R&D centers, faculty consulting, etc., does the most effective university-industry technology transfer occur?
3. What is the role of federal, state, and local government initiatives in promoting high-technology industry?
4. What are the benefits and the costs of technology transfer from universities to private firms, for the university (such as faculty conflicts-of-interest), for governments, and for private firms?
5. What lessons have been learned about promoting high-technology industry in a nation, state, or local area?

THE TECHNOLOGY TRANSFER PROCESS

Technology transfer is the main basis for the new university-industry relationships in the United States today. Technology transfer is the process through which the technological innovations that result from

basic and applied research are communicated to private firms, where they are commercialized.

Commercialization is the production, manufacturing, packaging, marketing, and distribution of a new product that embodies an innovation (Rogers, 1983, p. 143). Private companies usually do commercialization, and universities usually conduct most basic research, so a university-industry transfer of technology is often involved in the technology transfer process (at least in the United States). Technology can also flow from private firms to universities; the university-industry relationship is actually a two-way information-exchange.

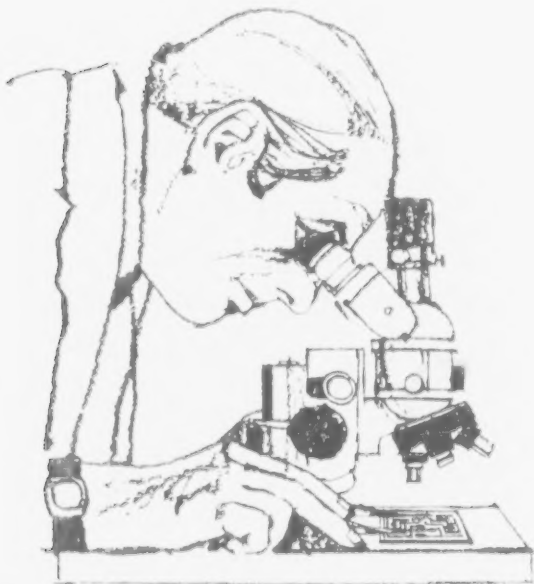
Basic research is defined as original investigations for the advancement of scientific knowledge that do not have the specific objective of applying this knowledge to practical problems. In contrast, applied research consists of scientific investigations that are intended to solve practical problems. Applied researchers are the main users of basic research.

Development of an innovation is the process of putting a new idea in a form that is expected to meet the needs of an audience of potential adopters/buyers. In the case of microelectronics, much of the "D" in Research and Development (R&D) is carried out by private industry, and the basic research is mainly conducted by universities, so a university-industry information-exchange has been involved for some years in the rapid technological advance of the microelectronics industry. What is new in recent years are the major collaborative research centers in microelectronics that are located on university campuses and funded mainly by private firms.

#1. WHY IS THE RESEARCH UNIVERSITY THE KEY INSTITUTION IN THE INFORMATION SOCIETY?

Fundamental to the growth of an Information Society is the rise of knowledge industries that produce and distribute information, rather than goods and services (Machlup, 1962). The university (1) produces information as the result of the research that it conducts, especially basic research, and

(2) produces information producers (individuals with graduate degrees, who are trained to conduct research). The information-producing role is particularly characteristic of the 50 or so research universities in the United States. A research university is an institution of higher learning whose main function is to perform research and provide graduate training.



The research university fulfills a role in the Information Society analogous to that of the factory in the Industrial Society. It is the key institution around which growth occurs, and it determines the direction of that growth. Each of the major high-technology regions in the United States is centered around a research university: Silicon Valley and Stanford University, Route 128 and MIT, and Research Triangle and the three main North Carolina universities (Duke, North Carolina State, and the University of North Carolina), for example.

A high-technology industry is characterized by (1) highly-educated employees, many of whom are scientists and engineers, (2) a rapid rate of technological innovation, (3)

a high ratio of R&D expenditures to sales (typically about 1:10), and (4) a worldwide market for its products. The main high-technology industries today are electronics, aerospace, pharmaceuticals, instrumentation, and biotechnology. Microelectronics, a subindustry of electronics centered on semiconductor chips and their applications (such as in computers), is usually considered the highest of high technology because the technology changes more rapidly than other high-technology industries.

It is particularly microelectronics technology, applied in the form of computers (especially microcomputers) and telecommunications, that is driving nations like the United States, Japan, and several Western European countries into becoming Information Societies. That is why the role of the research university in the transfer of microelectronics technology is so important to understanding the emergence of the Information Society. And why government policies affecting this technology transfer play a crucial role in shaping the Information Society.

#2. THROUGH WHAT MECHANISMS DOES UNIVERSITY-INDUSTRY TECHNOLOGY TRANSFER OCCUR?

The trend in recent years is to closer university-industry relationships, especially in the conduct of research. Why?

During the 1980s the federal government cut back severely on its funding of university research in many fields. Consequently, universities looked to private industry for research funds. The National Science Foundation estimates that industry funding of university research increased fourfold in the past decade to about \$300 million. During the 1980s many state and local governments launched initiatives to encourage the development of high-technology industry, in order to create new jobs and to fuel economic growth. Fearful of Japanese competition, U.S. microelectronics firms formed university-industry collaborative research centers, and invested considerable resources in funding these centers.

Largest of the new R&D centers is the Microelectronics and Computer Technology

Corporation (MCC), which decided in 1983 to locate on the campus of the University of Texas at Austin. Fifty-six other cities in 27 states competed with Austin for the MCC, with state and local governments offering a variety of incentives. Here is what 300 Texas leaders in state and local governments, universities, and private companies put together over a two-month period to win the MCC (Marks, 1983):

- \$20 million in single-family mortgage loans below prevailing interest rates; \$3 million in transition loans; a relocation office to facilitate utility hookups and to help place the spouses of MCC employees in jobs; \$500,000 to underwrite company relocation expenses; use of a Lear jet and a two-member crew for two years.
- 20 acres of land leased for a nominal fee of \$1 per year at the University of Texas' Balcones Research Center; construction and lease of a 200,000 square foot building (cost: \$20 million); and interim office space.
- From the University of Texas: \$15 million in endowed faculty positions; creation of 32 new faculty positions in microelectronics and computer science; \$750,000 in graduate fellowships; an additional \$1 million for research in microelectronics and computer science.
- From Texas A&M University: More endowed chairs in microelectronics and computer science; completion of an engineering research building with space for research; adjunct faculty status for MCC research staff.

Arizona Governor Bruce Babbitt, whose state was a finalist in the selection process, stated (1984): "Some 60 mayors and 27 governors complained about the unfair advantage of Texas oil money, and promised their constituents a better showing next time." Certainly the MCC decision heightened awareness among state and local officials about the importance of high-technology development, and created a fuller realization of the role of research universities in attracting high-technology firms.

What did the University of Texas, the state of Texas, and the city of Austin get in return for their offer to the MCC? Jobs and an infusion of big money to the state. The MCC is supported at \$75 million per year by a consortium of 18 U.S. firms that are the giants of the microelectronics industry, plus U.S. government research grants (mainly from the Department of Defense). The MCC presently has a research staff of 200, which will double in 1985. During its first year of operation, the MCC created a boomtown mentality in Austin. Fourteen high-technology firms moved all or part of their operations employing 6,100 people to Austin during 1983, while in 1982 only four companies with 900 jobs moved to Austin. The average selling price of a new single-family home rose 20 percent to \$106,157 during 1983.

But the main benefits to Austin of getting the MCC will accrue years from now, when a high-technology complex in microelectronics develops around Austin. It is possible that this complex may eventually rival or surpass California's Silicon Valley as a center for the production of information technology. In this sense, the MCC decision may have settled the location of the future capital of the Information Society.

The MCC is only one of several new university-industry research centers in microelectronics.

- The Center for Integrated Systems (CIS) at Stanford University was founded in 1981 and is supported by \$15 million from 20 U.S. microelectronics firms, and \$15 million from the U.S. Department of Defense. A new \$9 million building is nearing completion to house CIS' 30 faculty, 80 research staff, and 200 graduate students, plus industry R&D workers that are loaned to CIS by sponsoring firms for a one-year period.
- Arizona State University launched its Center for Solid-State Electronics Research as part of its Excellence in Engineering Program in 1981 to encourage the development of high-technology industry. Funding for the first five years consists

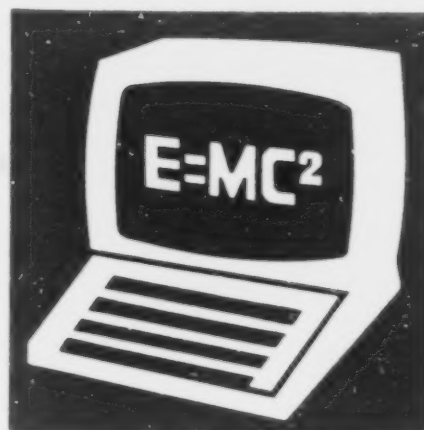
of \$20 million from the state of Arizona, \$10 million from private firms, and \$3 million from the federal government. About 34 new faculty positions have been added in microelectronics, and a \$13 million building has been constructed.

- The Microsystems Industrial Group at MIT is sponsored by about a dozen companies, many of them on Route 128.
- The Microelectronics Center of North Carolina (MCNC), a research and training facility in Research Triangle Park, was launched in 1981 with \$24 million from the state legislature.

Today there are about 25 university-industry microelectronics research centers at U.S. universities. Other such collaborative R&D centers have been founded for robotics, biotechnology, and other high-technology fields. In addition, many other technology transfer mechanisms are used by research universities.

- Research parks, like the Research Triangle Park in North Carolina and the Stanford Research Park (which was the first of its kind, and still is the most successful). The late Fred Terman, then vice-president and provost of Stanford University, launched the Stanford Research park in 1951, as part of his vision-for a West Coast electronics complex.
- Industrial liaison programs by universities, which provide a means for private firms to get an early look at research results and to identify promising students to hire as future employees, in exchange for paying an annual membership fee to the university.
- Faculty consulting by universities professors. President Carl Taylor Compton of MIT in the 1930s not only allowed his faculty to consult for pay one day a week, but strongly encouraged them to do so. Compton thought that faculty consulting was one of the most effective means of technology transfer from MIT's research laboratories to for-profit high

technology companies on Route 128. Since Compton's then radical policy on faculty consulting was launched, only one MIT professor has been censured for doing an excessive amount of consulting. After World War II, the MIT faculty consulting policy spread to Stanford University, and, in recent years, to a number of other research universities that wish to foster technology transfer.



- Especially in recent years, professors have formed companies of their own, often launching their start-up around a technological idea that they bring with them from their university laboratory. In some cases, the faculty entrepreneur who founds a high-technology company then cuts off his/her academic ties. Well-known examples are MIT's Ken Olson who founded DEC (Digital Equipment Corporation) and, more recently, Nobel-laureate biologist Walter Gilbert who left his Harvard professorship in favor of his role as board chairman of Biogen, Inc., a biotechnology company. Harvard wants its professors to devote 80 percent of their time to the university (this is a common "bag limit" on faculty for-profit activities at many universities today); Gilbert says he was spending 80 to 90 percent of his time in other than university responsibilities. The University of California system reviewed 5,000 professors' finan-

cial disclosure statements in 1982-83, and told seven faculty members to modify their industry ties. Some universities require that their faculty cannot serve as president, chairman of the board, chief executive officer, or other principal officer in a private firm. At other universities, the faculty are allowed any type of industry role, as long as it does not violate the 20 percent limit on work-time. At Stanford, the 80-member Department of Medicine in 1980 turned itself into a consulting collective to raise money which is then granted for research by junior faculty in the department (Culliton, 1982).

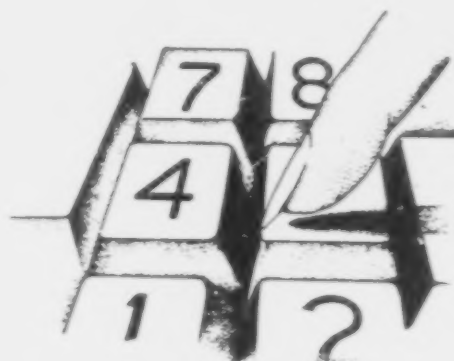
These and other novel means of technology transfer are being tried out by professors at research universities today.

#3. WHAT GOVERNMENT INITIATIVES PROMOTE HIGH-TECHNOLOGY INDUSTRY?

The Office of Technology Assessment (1984) identifies the allure of high-technology development: "state and local government leaders are attracted to high-technology industries because of the sector's rapid expansion and presumed job-creating potential. Some critics, however, believe that high-technology job projections are unrealistically high or that the potential for reviving distressed areas has been overstated."

Although state and local governments are far more active than the federal government in promoting high-technology development (OTA, 1984), a variety of federal policies and programs encourage high-technology industry to cooperate with research universities. The Economic Recovery Tax Act of 1981 provides a 25 percent tax credit for increased corporate R&D expenditures over a base year; up to 65 percent of research contracted to universities and to certain other institutions is covered by this Act. Further, federal policy allows firms to deduct from their taxes as charitable contributions part of the cost of equipment donated to universities. Changes in federal tax policies in recent years also has aided the expansion of venture capital; as a result, it has been easier to obtain financ-

ing to launch startup firms (Rogers and Larsen, 1984). One result is an increasing degree of entrepreneurship in starting new microelectronics firms throughout the United States, but especially around Boston and San Francisco/Silicon Valley, where venture capital firms are concentrated.



The recent easing by the federal government of anti-trust restrictions on collaborative R&D activities has facilitated closer university-industry relationships. The MCC in Austin could not have been founded had it not been for a favorable opinion by the U.S. Department of Justice on December 28, 1982. Then, in 1984, Federal legislation was passed to remove certain anti-trust barriers to collaborative R&D.

State governments have initiated 153 programs with a least some feature directed toward high-technology development, with 38 of these programs in 22 states dedicated to the creation, attraction, or retention of high-technology firms (OTA, 1984). The main thrust of these recent state programs has been to coordinate the activities of state and local governments, private industry, and universities to facilitate technology transfer between the university and surrounding high-technology firms (National Governors' Association, 1983; OTA, 1984). State and local laws also are factors affecting technology transfer and the development of high-technology industry. For example, lack of a state income tax in Texas is cited by some firms as an important reason why they moved to Austin.

Government officials may identify potential high-technology firms and encourage these companies to locate in their particular jurisdiction. The competition among state and local governments is especially fierce in seeking collaborative university-industry research centers in microelectronics. For example, the Texas Governor's Office played a very important role in convincing the MCC to locate in Austin, as did the mayor of Austin and the mayor of San Antonio.

#4. WHAT ARE THE BENEFITS AND COSTS OF UNIVERSITY-INDUSTRY RELATIONSHIPS?

Clearly the university-industry collaborative research centers in microelectronics represent a new and important force on the university campus, and one that has already generated a great deal of policy controversy. Some observers see this recent development in a very positive light. Governor Bruce Babbitt (1984) of Arizona refers to "a new awareness that the fruits of university research and development activity have little economic value unless they are systematically harvested in the marketplace." The university obviously benefits from the research funds that it receives, and the professors may gain useful experience which they can incorporate into their courses for the benefit of their students.

In general, both the research universities and private industry are pleased with their new, closer relationships. Microelectronics companies feel that their membership fees paid to the collaborative university-industry research centers are one means of dealing with Japanese competition (for example, the MCC justifies its existence publicly as the U.S. response to the Japanese Fifth-Generation Computer Project). In addition, semiconductor companies in Silicon Valley report they participate in the collaborative centers as a means to identify future employees and faculty consultants from among university students and professors.

The several state and local governments promoting high-technology development feel they are winners as a result of the closer university-industry relationships.

But there are also a variety of problems connected with the industry-sponsored research centers on university campuses. For instance, the priorities accorded by a university to certain disciplines and to certain research problems may be affected by the priorities of private firms that donate research funds, thus causing a feeling of relative deprivation on the part of departments and professors not so favored. The growing emphasis on technology may come at the expense of arts and humanities. University scientists fear that the price of industry collaboration will be a shift from basic research to more product-oriented development.

Problems of inequality also can occur between universities, as well as within a university. When Stanford, Texas, Arizona State, and MIT create university-industry collaborative research centers in microelectronics, are other universities adversely affected? Hancock (1983) noted that in the new era of university-industry relationships, "One trend is apparent; corporate money goes to the academic haves, not the have-nots."

"Concern about the propriety of university-industry relations has been a central theme on the country's research campuses for the past couple of years" (Culliton, 1983). Perhaps one turning point in the recognition of this problem occurred in 1982 when the presidents of five universities met with 11 corporate leaders at Pajaro Dunes (California) to explore such questions as: "How can universities preserve open communication and independence in the direction of basic research while also meeting obligations to industry? Is it acceptable for one corporation to dominate research in an entire (academic) department? Are there adverse consequences in terms of collaboration among faculty in various departments if one group must worry about protecting corporate right to licenses? Will extensive corporate ties erode public confidence in university faculty as disinterested seekers of truth?" (Science, 1982)

The Twentieth Century Fund Task Force on the Commercialization of Scientific Re-

search (1964) highlighted this conflict-of-interest problem: "Ties between the scientific community and corporations, and between corporations and universities, are not, of course, new. Such ties are the one reason for the continued supremacy of American science. But the new relationships differ in magnitude and extend from past relationships, introducing the possibility of conflicts of interest." The general conclusion is that research universities should move carefully into their new partnership relations with private industry.

In summary, there are three main points of potential conflict between the university and private firms in the present era of closer relationships:

1. Restrictions on the communication of research results, where company secrecy policies may conflict with the scientific desire for free communication.
2. The relatively short-term orientation of the private firms versus the longer-term orientation of university scientists toward basic research.
3. The agenda of priorities for university research may be affected by corporate sponsorship, with emphasis upon scientific fields with a direct potential for commercial payoff.

Clearly the new relationships between industry and the university, often fostered by government initiatives and intended to encourage high-technology development, deserve careful research and analysis. Such investigation has not been mounted to date.

#5. WHAT ARE THE LESSONS LEARNED ABOUT PROMOTING HIGH-TECHNOLOGY INDUSTRY?

Conventional wisdom in recent years indicated that state and local governments are engaging in futile activity when they try to attract high-technology firms away from other locales in the United States. Instead, it seems more effective for a state or city to grow its own high-technology industry. And the seed for starting local entrepreneurial activities is to invest in improving a research university, especially

in such academic departments as electrical engineering, computer science, and molecular biology. An investment in improving these university departments is likely to pay off, eventually, in technology transfer to private firms, and, still later, to generating an entrepreneurial head of steam in starting-up high-tech firms.



It should be recognized that a considerable time lag is usually involved from the improvement of a research university, to the rise of a local high-technology industry. Clear evidence on this point is provided by the case of Research Triangle in North Carolina. Governor Luther H. Hodges had the original vision of a North Carolina high-technology center back in the 1950s. Hodges followed the Stanford University model of establishing a university research park in order to create a high-technology complex. Only after 20 years of concerted efforts did high-tech firms begin to move to Research Triangle, with the key turning point occurring in 1965 when IBM located an R&D unit there. Total employment in Research Triangle Park's 40 firms is now over 20,000 with an annual payroll of \$500 million (Rogers and Larsen, 1984, p. 241). But there is not yet much entrepreneurial activity in starting up new firms. Several decades were also necessary for the rise of

Silicon Valley in Northern California and for the beginnings of Route 128 around Boston. So high-technology industry does not get underway overnight. On the other hand, the present Austin take-off is occurring very rapidly.

The presence of an outstanding research university in a locale does not necessarily cause the development of a high-technology center. Evidence of this point is provided by such excellent universities as Harvard, Columbia, Chicago, Berkeley, and Cal Tech, none of whom have played an important role in technology transfer to local firms. Obviously, other factors than just the presence of a local research university are involved in launching a high-technology center; a high quality-of-life, entrepreneurial spirit, and the presence of venture capital, are also important. And even when a research university is present, it must have policies that encourage faculty to assist local firms, or else not much technology transfer will occur. Such favorable policies exist at Stanford, MIT, Texas, Arizona State, the North Carolina universi-

ties, and, increasingly, at other universities. Harvard, Berkeley and other outstanding research universities do not particularly encourage technology transfer. And so their potential for encouraging high-technology industry is not realized.

CONCLUSION

The research university in the United States is changing its role from mainly that of conducting basic research to also taking a more active role in transferring technology to private firms. The most advanced case of this trend is happening in microelectronics, a scientific field that is driving the Information Society.

Whether the trend to closer university-industry relationships will result in greater benefits than costs to the participants, and to society, remains to be seen.

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AVERAGE FACULTY SALARIES

The following table contains selected data from an article entitled, "Average Salaries for Full-Time Faculty Members this Year at more than 1,700 U.S. Colleges and Universities" which appeared in the April 24, 1985 issue of The Chronicle of Higher Education. It shows 1984-85 average salaries for full-time faculty members (excluding medical schools) by rank at four-year institutions in Arizona and some neighboring states. The

figures are reported in thousands of dollars and are rounded out to the nearest hundred. They are adjusted to a standard nine-month basis. A blank appears when the institution has no faculty members at that rank. A dash indicates that there are five or fewer faculty members at that rank. Data to control for time-in-rank, productivity, and market factors were not available.

AVERAGE SALARIES AT SELECTED FOUR-YEAR INSTITUTIONS

<u>Arizona</u>	<u>Prof.</u>	<u>Assoc.</u>	<u>Assist.</u>	<u>Instructor</u>
University of Arizona	42.9	31.4	25.9	22.9
Arizona State University	42.3	32.0	26.2	20.4
Northern Arizona University	38.0	30.3	24.9	20.1
Grand Canyon College	28.3	22.5	18.9	17.5

	Prof.	Assoc. Prof.	Assist. Prof.	Instructor
<u>California</u>				
University of California - Berkeley	54.3	34.9	29.6	--
University of California - Los Angeles	51.7	33.7	28.7	--
University of California - San Diego	50.4	33.4	28.5	
California State University - Fresno	41.4	31.4	25.5	22.8
California State University - San Francisco	41.4	31.1	25.5	22.3
California State University - San Bernadino	40.5	31.6	25.6	22.3
University of Southern California	50.8	35.3	29.7	26.3
Stanford	58.3	40.5	31.7	--
Claremont - McKenna	41.7	31.6	26.7	--
<u>Colorado</u>				
University of Colorado - Boulder	39.1	30.6	27.1	22.8
University of Colorado - Denver	36.2	29.3	25.7	20.0
Colorado State University	35.6	28.2	24.2	19.2
University of Denver	38.3	28.2	24.8	23.2
University of Southern Colorado	31.9	28.0	22.9	--
University of Northern Colorado	34.3	27.4	22.6	19.9
<u>Nevada</u>				
University of Nevada - Las Vegas	37.5	29.6	25.5	21.2
University of Nevada - Reno	36.3	29.2	23.8	19.9
<u>New Mexico</u>				
University of New Mexico	39.4	29.3	24.2	19.0
Eastern New Mexico University	35.7	29.8	25.0	20.4
New Mexico State University - Main Campus	37.8	28.9	24.1	19.0
New Mexico State University - Alamogordo	--	27.4	22.2	20.5
<u>Utah</u>				
University of Utah	41.6	29.8	25.4	20.9
Utah State University	36.8	29.1	24.3	21.0
Weber State College	33.6	28.0	24.3	19.6
Southern Utah State College	30.8	25.5	22.0	19.6

The salaries in the table are divided by rank, starting with the highest paid, the full professor or "Prof." The next highest paid is the associate professor who has tenure but has not yet made full professor. Assistant professors are next. These are new professors usually, and do not yet have tenure. The lowest paid are instructors who are often graduate students or new Ph.Ds. Therefore, in every case, salaries decrease as you go from left to right on any row.

One would expect salaries to be higher in California due to their high cost of living, but the table bears this out only for certain of its colleges and universities. The University of California system's salaries are higher than Arizona's, as are USC

and Stanford, but the California State University System is about comparable to Arizona State University and the University of Arizona.

Colorado, New Mexico, Nevada, and Utah all pay less to their faculty than ASU or the University of Arizona. These state's four-year institutions are more comparable in pay to our Northern Arizona University.

The highest salary in this specific table is \$58,300, which is paid to a full professor at Stanford. The lowest salary is \$17,500, which is paid to an instructor at Grand Canyon College here in Arizona.

Nancy Augustin

THE ARIZONA LABOR FORCE IN APRIL 1985

Unemployment in Arizona climbed to 5.9 percent of the labor force in April, a 0.1 percent increase over the revised March figure. This marks the fifth consecutive month that the rate has increased from November's low of 4.3 percent. Although 4,200 wage and salary jobs were added last month, the increase was small compared to the increase of 13,100 jobs recorded in April 1984. The slowing rate of growth seen recently in Arizona suggests that unemployment may continue to increase.

As the state economy cools down, the growth pattern is showing similarities to recent trends at the national level. The U.S. economy has created very few manufacturing jobs during the last twelve months, while employment in the service-producing sectors has continued to rise steadily. In Arizona, manufacturing employment is increasing, but most of the recent gains have resulted from brisk hiring by the state's producers of aircraft, missiles, and other defense-related equipment. Electronics manufacturers that depend on private sector markets are suffering from weak product demand, forcing many to cut back production. Some layoffs have resulted, but the unemployment statistics do not reflect reductions in work schedules among production workers. With the industry "book-to-bill" ratio falling again in April, it will be several months at least before these firms can resume normal operations.

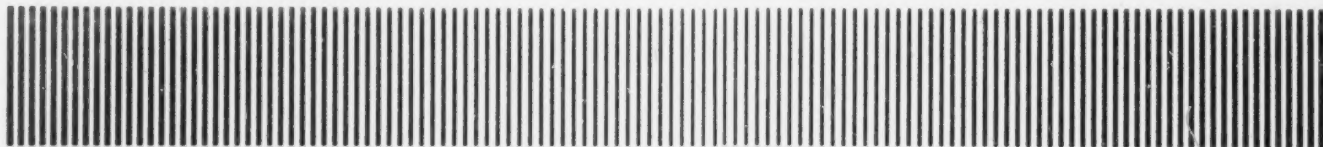
Construction employment remains a bright spot. With 1,500 new jobs last month, the industry employment level reached 109,000, a new record for Arizona. Falling interest rates should keep the home-building sector healthy in the short run, while office construction remains strong despite a surplus of available space. Some layoffs may be ob-

served later in the year if the excess inventory of office space continues to grow.

The retail trade sector produced mixed results last month. Employment was down sharply in the Phoenix area as a strong winter tourism season came to an end, but most areas of the state added jobs. Food stores and restaurants throughout the state have created jobs this year in response to the needs of a rapidly expanding population.

Aside from some expected seasonal declines, most of the service-producing industries were expanding in April. Employment in the financial sector continued to show strong increases, and business, health, and agricultural services also registered significant gains. Hotels and lodging establishments in the northern counties and recreation areas are staffing up for the summer, while new facilities open for business in Tucson are reducing the number of layoffs that usually occur at the end of the winter season.

The current pattern should continue in the near future. Employment in manufacturing will grow as Arizona's defense contractors continue to increase production. Other manufacturing firms, especially in high technology, may continue to lay off workers until market conditions improve. A rising population, combined with a rapidly expanding consumer market, should continue to create job opportunities in the state's retail, financial, and service industries. However, if the electronics industry continues to be plagued by the current slump in product demand, unemployment will rise, and the economy of Arizona will continue to mark time while seeking a new direction.



Arizona Labor Force and Employment

April 1985 (in thousands)

	ARIZONA				
	Apr.* 1985	Mar. 1985	Apr. 1984	-- Amt Change -- Mar. 1984 to Apr. 1985	
TOTAL CIVILIAN LABOR FORCE	1473.0	1484.1	1426.7	-11.1	+46.3
Total Unemployment	84.3	84.9	71.4	-0.6	+12.9
Rate	5.7	5.7	5.0	---	---
Rate (Sea. Adj.)**	5.9	5.8	5.2	---	---
Total Employment	1388.7	1399.2	1355.3	-10.5	+33.4

THE ABOVE LABOR FORCE STATISTICS SHOULD NOT

NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT BY PLACE OF WORK

TOTAL WAGE AND SALARY	1260.9	1256.7	1174.3	+4.2	+86.6
Manufacturing	180.7	180.1	168.9	+0.6	+11.8
Durable Goods	143.4	142.7	132.8	+0.7	+10.6
Stone, Clay and Glass	7.9	7.7	7.3	+0.2	+0.6
Primary and Fabricated Metals	15.9	16.9	15.6	+0.0	+1.3
Primary Metals	7.2	7.2	6.6	+0.0	+0.6
Fabricated Metals	9.7	9.7	9.0	+0.0	+0.7
Machinery	71.8	71.7	66.9	+0.1	+4.9
Other Durable Goods	46.8	46.4	43.0	+0.4	+3.8
Aircraft and Missiles	21.2	20.9	19.2	+0.3	+2.0
Lumber and Wood Products (Except Furniture)	7.0	6.9	7.1	+0.1	-0.1
All Other Durable Goods	18.6	18.6	16.7	+0.0	+1.9
Nondurable Goods	37.3	37.4	36.1	-0.1	+1.2
Food and Kindred Products	7.9	7.8	7.8	+0.1	+0.1
Apparel	4.6	4.7	5.1	-0.1	-0.5
Printing and Publishing	14.3	14.3	13.3	+0.0	+1.0
All Other Nondurable Goods	10.5	10.6	9.9	-0.1	+0.6
Mining and Quarrying	12.3	12.3	13.5	+0.0	-1.2
Copper Mining	9.6	9.6	10.6	+0.0	-1.0
Other Mining and Quarrying	2.7	2.7	2.9	+0.0	-0.2
Construction	109.0	107.5	92.9	+1.5	+16.1
Trans., Communications, and Public Utilities	62.4	62.7	59.4	-0.3	+3.0
Transportation	28.6	28.9	26.8	-0.3	+1.8
Communications and Public Utilities	33.8	33.8	32.6	+0.0	+1.2
Trade	303.9	303.8	282.4	+0.1	+21.5
Wholesale Trade	62.7	62.9	57.7	-0.2	+5.0
Retail Trade	241.2	240.9	224.7	+0.3	+16.5
General Merchandise and Apparel	38.6	38.8	37.3	-0.2	+1.3
Food Stores	37.0	36.5	34.5	+0.5	+2.5
Automotive and Service Stations	28.8	28.5	26.7	+0.3	+2.1
Eating and Drinking Places	85.5	85.5	79.5	+0.0	+6.0
Other Retail Trade	51.3	51.6	46.7	-0.3	+4.6
Finance, Insurance, and Real Estate	75.3	75.0	70.7	+0.3	+4.6
Services and Miscellaneous	295.3	293.5	273.0	+1.8	+22.3
Hotels and Other Lodging Places	32.4	32.3	28.7	+0.1	+3.7
Business Services	66.1	65.4	59.4	+0.7	+6.7
Health Services	71.0	70.5	68.3	+0.5	+2.7
Other Services	125.8	125.3	116.6	+0.5	+9.2
Government	222.0	221.8	213.5	+0.2	+8.5
Federal	40.1	39.7	38.4	+0.4	+1.7
State and Local	181.9	182.1	175.1	-0.2	+6.8
School	110.8	111.7	108.4	-0.9	+2.4

* Preliminary

** Normal seasonal variations have been eliminated to reflect underlying economic trends.

NOTE--Prepared in cooperation with the U.S. Department of Labor, Bureau of Labor Statistics.

Arizona Labor Force and Employment

April 1985 (in thousands)

----- MARICOPA COUNTY -----					----- PIMA COUNTY -----				
Apr.*	Mar.	Apr.	-- Amt Change --		Apr.*	Mar.	Apr.	-- Amt Change --	
1985	1985	1984	Mar.	to Apr. to 1985	1985	1985	1984	Mar.	to Apr. to 1985
938.0	946.3	899.7	-8.3	+38.3	267.9	269.6	260.6	-1.7	+7.3
41.1	41.6	34.8	-0.5	+6.3	14.2	14.1	11.6	+0.1	+2.6
4.4	4.4	3.9	---	---	5.3	5.2	4.5	---	---
4.5	4.5	4.0	---	---	5.5	5.2	4.6	---	---
896.9	904.7	864.9	-7.8	+32.0	253.7	255.5	249.0	-1.8	+4.7

BE USED FOR ECONOMIC ASSISTANCE PROGRAMS.

NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT BY PLACE OF WORK

829.1	827.1	763.4	+2.0	+65.7	228.3	227.6	213.9	+0.7	+14.4
131.7	131.5	122.7	+0.2	+9.0	30.8	30.5	28.2	+0.3	+2.6
105.8	105.5	97.5	+0.3	+8.3	25.8	25.5	23.4	+0.3	+2.4
4.7	4.7	4.3	+0.0	+0.4					
11.3	11.2	9.9	+0.1	+1.4					
57.8	57.8	53.9	+0.0	+3.9					
32.0	31.8	29.4	+0.2	+2.6					
25.9	26.0	25.2	-0.1	+0.7	5.0	5.0	4.8	+0.0	+0.2
5.1	5.1	5.3	+0.0	-0.2					
2.8	2.8	3.1	+0.0	-0.3					
10.5	10.5	9.7	+0.0	+0.8					
7.5	7.6	7.1	-0.1	+0.4					
0.6	0.6	0.6	+0.0	+0.0	2.5	2.5	3.7	+0.0	-1.2
76.9	75.8	64.4	+1.1	+12.5	19.9	19.8	17.2	+0.1	+2.7
41.0	41.0	38.2	+0.0	+2.8	8.8	8.8	8.9	+0.0	-0.1
19.6	19.8	17.9	-0.2	+1.7	4.0	4.0	4.0	+0.0	+0.0
21.4	21.2	20.3	+0.2	+1.1	4.8	4.8	4.9	+0.0	-0.1
206.8	207.0	191.7	-0.2	+15.1	50.3	50.1	46.8	+0.2	+3.5
49.5	49.1	45.9	+0.4	+3.6	7.3	7.2	6.4	+0.1	+0.9
157.3	157.9	145.8	-0.6	+11.5	43.0	42.9	40.4	+0.1	+2.6
24.1	24.3	23.6	-0.2	+0.5	7.5	7.7	7.3	-0.2	+0.2
23.6	23.3	22.1	+0.3	+1.5	5.9	5.8	5.5	+0.1	+0.4
18.5	18.4	16.8	+0.1	+1.7	4.5	4.4	4.3	+0.1	+0.2
55.3	55.8	51.0	-0.5	+4.3	16.3	16.2	15.1	+0.1	+1.2
35.8	36.1	32.3	-0.3	+3.5	8.8	8.8	8.2	+0.0	+0.6
58.7	58.5	55.1	+0.2	+3.6	10.6	10.6	10.0	+0.0	+0.6
201.9	201.5	184.6	+0.4	+17.3	54.6	54.4	50.2	+0.2	+4.4
20.1	20.5	17.2	-0.4	+2.9	4.9	5.1	4.5	-0.2	+0.4
53.7	53.4	49.3	+0.3	+4.4	9.6	9.4	8.0	+0.2	+1.6
48.2	48.0	46.2	+0.2	+2.0	14.3	14.1	13.9	+0.2	+0.4
79.9	79.6	71.9	+0.3	+8.0	25.8	25.8	23.8	+0.0	+2.0
111.5	111.2	106.1	+0.3	+5.4	50.8	50.9	48.9	-0.1	+1.9

NONMETROPOLITAN COUNTIES LABOR FORCE AND EMPLOYMENT APRIL 1985

	<u>Apache</u>	<u>Cochise</u>	<u>Coconino</u>	<u>Gila</u>	<u>Graham</u>	<u>Green- lee</u>	<u>La Paz</u>
TOTAL CIVILIAN LABOR FORCE*	15,250	29,000	35,925	12,825	7,825	3,075	4,725
Total Unemployment	2,075	2,250	2,850	1,575	900	425	675
Rate	13.6%	7.8%	7.9%	12.3%	11.5%	13.8%	14.3%
Rate (Seas. Adj.)**	15.0%	7.9%	8.3%	12.5%	11.6%	14.4%	-INA
Total Employment	13,175	26,750	33,075	11,250	6,925	2,650	4,050

THE ABOVE LABOR FORCE STATISTICS SHOULD NOT BE USED
FOR ECONOMIC ASSISTANCE PROGRAMS

TOTAL WAGE AND SALARY.	14,650	23,150	33,125	9,750	4,675	2,650	2,475
Manufacturing.	600	1,925	2,425	1,250	150	75	75
Mining and Quarrying	25	175	50	1,600	50	1,525	0
Construction	1,075	1,400	1,575	425	150	100	75
Trans., Comm., & Pub. Util..	1,975	1,425	2,475	300	150	50	50
Trade.	1,300	4,925	7,550	1,925	1,350	275	825
Fin., Insur., & Real Estate.	275	650	725	225	125	25	75
Services and Miscellaneous .	4,000	3,100	7,725	1,775	750	100	650
Government	5,400	9,550	10,600	2,250	1,950	500	725

	<u>Mohave</u>	<u>Navajo</u>	<u>Pinal</u>	<u>Santa Cruz</u>	<u>Yavapai</u>	<u>Yuma</u>
TOTAL CIVILIAN LABOR FORCE*	24,075	24,700	32,425	8,625	32,875	35,825
Total Unemployment	2,600	2,900	3,900	950	2,150	5,825
Rate	10.8%	11.7%	12.0%	11.0%	6.5%	16.3%
Rate (Seas. Adj.)**	11.0%	12.1%	12.5%	13.0%	6.5%	-INA-
Total Employment	21,475	21,800	28,525	7,675	30,725	30,000

THE ABOVE LABOR FORCE STATISTICS SHOULD NOT BE USED
FOR ECONOMIC ASSISTANCE PROGRAMS

TOTAL WAGE AND SALARY.	17,575	18,200	25,950	8,250	19,700	3,275
Manufacturing.	2,275	1,750	3,225	775	2,150	1,600
Mining and Quarrying	225	1,125	3,700	0	650	50
Construction	1,400	850	1,025	300	1,750	2,025
Trans., Comm., & Pub. Util..	1,125	1,575	1,175	575	900	900
Trade.	4,950	3,275	4,550	3,625	5,100	7,175
Fin., Insur., & Real Estate.	850	375	700	250	800	875
Services and Miscellaneous .	3,550	4,675	3,050	1,250	3,850	4,225
Government	3,200	4,575	8,525	1,475	4,500	6,425

*Adjusted to the Current Population Survey (CPS) to reflect place of residence.

**Seasonal adjustment not applicable for economic assistance programs.

NOTE--Series for Yuma and La Paz counties start January 1983. Data are not comparable to any past series.

Prepared in conjunction with the U.S. Department of Labor, Bureau of Labor Statistics

ARIZONA LABOR FORCE AND EMPLOYMENT FOR ECONOMIC ASSISTANCE PROGRAMS APRIL 1985

County	Civilian Labor Force	Employment	Unemployment	Rate
Statewide	1,473,040	1,388,731	84,309	5.7%
Apache	15,258	13,191	2,067	13.5
Cochise	29,013	26,752	2,261	7.8
Coconino	35,922	33,073	2,849	7.9
Gila	12,824	11,261	1,563	12.2
Graham	7,833	6,936	897	11.5
Greenlee	3,085	2,650	435	14.1
La Paz	4,713	4,039	674	14.3
Maricopa	937,950	896,897	41,053	4.4
Mohave	24,081	21,480	2,601	10.8
Navajo	24,698	21,809	2,889	11.7
Pima	267,918	253,729	14,189	5.3
Pinal	32,424	28,526	3,898	12.0
Santa Cruz	8,619	7,667	952	11.0
Yavapai	32,876	30,719	2,157	6.6
Yuma	35,826	30,002	5,824	16.3

These figures are the only official BLS labor statistics to be used for revenue sharing purposes. They are not designed to be used as economic indicators. Note: Series for Yuma and La Paz counties start January 1983. Data are not comparable to any past series.

ESTIMATED HOURS AND EARNINGS OF PRODUCTION WORKERS IN SELECTED INDUSTRIES IN ARIZONA APRIL 1985

----- ESTIMATED HOURS AND EARNINGS OF PRODUCTION WORKERS IN SELECTED INDUSTRIES IN ARIZONA -----
APRIL 1985

INDUSTRY	AVERAGE WEEKLY EARNINGS			AVERAGE WEEKLY HOURS			AVG. HOURLY EARNINGS		
	APR.* 1985	MAR. 1985	APR. 1984	APR.* 1985	MAR. 1985	APR. 1984	APR.* 1985	MAR. 1985	APR. 1984
FOR THE STATE OF ARIZONA									
Manufacturing	382.85	379.22	373.42	40.3	40.3	40.9	9.50	9.41	9.13
Aircraft & Missiles	INA	INA	INA	INA	INA	INA	INA	INA	INA
Food & Kindred Products	303.07	329.26	315.75	40.9	40.5	38.6	7.41	8.13	8.18
Primary Metals	509.04	497.32	473.37	40.4	40.4	37.9	12.60	12.31	12.49
Machinery	339.63	340.16	341.07	39.4	39.6	40.7	8.62	8.59	8.38
Copper Mining	587.30	576.72	525.60	42.9	42.5	39.4	13.69	13.57	13.34
Construction	429.69	422.33	420.95	36.2	35.7	36.7	11.87	11.83	11.47
Utilities	566.80	566.80	531.27	43.6	43.6	42.4	13.00	13.00	12.53
Retail Trade**	235.55	235.55	248.68	35.0	35.0	34.3	6.73	6.73	7.25
Wholesale Trade	363.06	364.42	353.63	38.5	38.4	39.6	9.43	9.49	8.93

* Preliminary

** Excludes eating and drinking places.

NOTE--These estimates are based on a sample of full and part-time production and related employees whose payroll and hours are reported for the pay period which includes the 12th of the month. Prepared in cooperation with the U.S. Department of Labor, Bureau of Labor Statistics.

--Prepared by Labor Market Information, Research and Analysis

(1972 SIC, 1/84)

ARIZONA UNEMPLOYMENT INSURANCE ACTIVITIES - MARCH 1985

	MARCH 1985	FEBRUARY 1985	MARCH 1984	% Change From One Year Ago
Arizona Claimants Served*	28,698	25,746	30,282	- 5.2%
Arizona Average Weeks Unemployed**	8.7	8.3	9.3	- 6.5%
Arizona Benefits Paid*	\$ 9,284,576	\$ 8,017,128	\$ 10,855,611	-14.5%
Arizona Trust Fund Balance	\$245,896,002	\$251,846,691	\$160,999,182	+52.7%

*All Programs

**UI Only



EMPLOYMENT IN ARIZONA: WHAT WILL HAPPEN IF . . . ?

Economists are often asked questions such as "What will happen to employment if there is a recession?"; "How low can the unemployment rate go?"; or "What would happen to construction employment if interest rates rise?". This article will attempt to answer these questions and others by simulating the effects of two different national economic scenarios on employment using a model of the Arizona economy.

The first scenario assumes that the national economy gains momentum in the second half of this year causing the Federal Reserve to tighten the money supply to prevent a rise in inflation. Unfortunately, the Fed overreacts and interest rates rise dramatically, inducing a recession beginning in the second quarter of 1986 and ending in the first quarter of 1987. Although interest rates ease in 1987, real Gross National Product (GNP) growth remains a sluggish 1.4 percent for the year.

In the second scenario, the nation continues to experience the strong growth that began in 1983. Interest rates continue to

decline through 1986 and real GNP grows a healthy 4.2 percent in 1985 and 3.8 percent in 1986. This strong growth is also accompanied by an inflation rate of around 3 percent. For a comparison of some of the key national variables in each scenario, see Table I.

RECESSION SIMULATION

The recession simulation begins with the economy performing very well in 1985. In fact, the strong national economy in the second half of the year causes Arizona's employment to be greater and unemployment lower in the recession simulation than in the optimistic simulation in 1985. However, by 1986, rising interest rates and a declining real GNP result in the state's unemployment rate rising to 7.4 percent and employment growth slowing to just over 1 percent. Locally, Maricopa County's unemployment rate would rise to 5.6 percent in 1986 from 4.2 percent in 1985; unemployment would rise in Pima County to 7.3 percent of the labor force from 5.4 percent; the non-metro counties would experience an unem-

ployment rate of 13.6 percent, up from 11.3 percent the previous year.

As in most recessions, construction employment is the first to experience significant layoffs. In 1986, construction employment declines by 4.5 percent statewide with even greater losses in Pima County and the non-metro counties. In Maricopa County, construction employment declines by only 3.2 percent. The stronger performance in Maricopa County is due primarily to two factors. The first factor is the large amount of public works construction currently underway or scheduled to begin in 1986. The second factor is that the county is going to continue to attract a large number of people from other parts of the country, creating a strong demand for housing. This strong population growth is unlikely to be affected by the recession since the county's unemployment rate will still be well below the national rate.

Manufacturing employment typically lags behind the business cycle and this recession is no exception. Unlike construction employment, manufacturing employment manages to grow slightly in 1986, increasing by 1.7 percent. This rate is significantly below the 9.4 percent growth experienced in 1985. The hardest hit industry is non-electrical machinery manufacturing which loses over 600 jobs, primarily in Maricopa County. Employment growth also slows considerably in electrical machinery (2.1 percent) where many of the state's "high-tech" firms are classified. The one industry that helps to stabilize employment is aircraft and missiles. With a strong boost from defense spending, this industry experiences a 7.3 percent increase in employment, statewide, in 1986.

Employment growth also slows considerably in the trade and service industries in 1986. In fact, the 2.2 percent growth in service employment, statewide, would be the lowest on record. Particularly sluggish sectors include the hotels and motels and business services in Maricopa County. The hotel and motel industry typically experiences slow growth during recessions due to fewer dollars available for vacations and a reduction in convention attendance. Growth

in business service employment slows because of weaker demand for temporary help, the reduction in advertising that occurs during recessions and slower business formation which reduces the need for janitorial services. Trade employment grows by only 1.7 percent in 1986, the third lowest rate on record. Clearly, the fall in demand during a recession will reduce employment in sectors like department stores and automotive trade.

The finance, insurance, and real estate (F.I.R.E.) and transportation, communication, and public utilities (T.C.P.U.) industries, overall, tend to be less cyclical than the above industries. The slower employment growth that does occur is primarily due to declines in real estate and transportation employment. Government employment, also fairly insensitive to the business cycle, continues to grow at a modest rate.

The mining industry continues to have problems in 1985, losing 2.3 percent of its employment. However, the strong economy in late 1985 results in some employment growth in 1986.

The recession finally starts to end by spring of 1987 as interest rates decline. Spurred by lower interest rates, the construction industry begins to recover in 1987 and manages to increase employment by 2.7 percent statewide. Manufacturing employment, because of its lagging nature, declines in 1987 by 1.1 percent. The most severe reductions occur in the aircraft and missile sector, due to cuts in the defense budget; and the non-electrical machinery sector, particularly those related to computer manufacturing. Employment in the semiconductor industry is expected to grow, but only by 1.4 percent.

The trade and service industries moves in opposite directions in 1987. The trade industry loses 800 jobs for the year, mostly related to weakness in manufacturing. This is illustrated by the sub-state data. In Maricopa County, where the loss in manufacturing employment is greatest, the loss in trade employment is also greatest. Service employment, on the other hand, grows by

3 percent in 1987. This growth takes place primarily in medical services and hotels and motels.

Mining employment declines significantly in 1987, reflecting its lagging nature. For the year, 3,500 jobs are lost statewide.

Overall, 1987 is not a very good year for Arizona. The loss of jobs in manufacturing and trade helps to boost the state's unemployment rate to 7.5 percent. For the year, employment grows by only 0.7 percent.

By 1988, the recovery is gaining strength, resulting in employment growth in the state of 5.5 percent and the decline of the unemployment rate to 5.5 percent. Locally, the unemployment rate declines to 4.5 percent in Maricopa County, 4.8 percent in Pima County and 9.7 percent in the nonmetro counties. Manufacturing employment, particularly "high-tech" manufacturing, experiences growth comparable to 1984. Lower interest rates also help to further boost the recovery in the construction industry that began in 1987. Strong employment growth also takes place in the remaining industries (See Table II for details).

OPTIMISTIC SIMULATION

The optimistic simulation assumes that the state and national economies will grow at a rate approaching their long run trend. Statewide, employment increased by 4.5 percent in 1985, 3.5 percent in 1986, 3.0 percent in 1987, and 3.4 percent in 1988. In the short run, the state's unemployment rate rises, due primarily to strong population growth. However, unemployment peaks in 1986 at a fairly low level of 6.1 percent of the labor force. By 1988 the unemployment rate is down to 4.2 percent.

Over the four year period, approximately 209,000 jobs are added to the state economy. The vast majority of these new jobs, about 70 percent, are in Maricopa County. Pima County's employment increases by over 34,000 and the nonmetro counties have an additional 25,200 people employed.

The industry with the largest number of new jobs by 1988 is trade with over 55,000.

Services is a close second with additional employment of 51,300. Within trade and services, the fastest growing sectors are wholesale trade, eating and drinking establishments, business services, and all other services (legal, personal, and educational).

Arizona's manufacturing industry by this simulation has an additional 42,400 workers by 1988. However, this growth is not distributed proportionally among the counties. Maricopa County receives approximately 82 percent of this growth (34,900 jobs), due primarily to military-related and semiconductor manufacturing. Manufacturing employment in the nonmetro counties increases by 5,200. The best performing sectors in the rural areas are stone, clay and glass, non-electrical machinery and electrical machinery. Pima County, on the other hand, appears to have some problems with its manufacturing industry in the short run, losing employment in both 1986 and 1987. The sources of these losses are related to problems in the small aircraft, fabricated metals, and non-electrical machinery (computer-related) industries. By 1988, however, growth resumes and the long run outlook is good.

Lower interest rates in the optimistic simulation help to boost construction employment considerably. Statewide, employment in the industry grows by over 21 percent from 1984 to 1988. In Maricopa County there are an additional 12,700 construction workers, a 19.2 percent increase. The majority of the growth would be among general contractors and special trades. Pima County experiences an even larger percentage increase (20.3 percent) than Maricopa County. In Pima County, though, the employment growth is spread among all categories of construction. The nonmetro counties also see an increase in construction activity over the next four years. This activity translates into 3,800 jobs and a 32.2 percent increase by 1988.

Mining employment also recovers in the optimistic simulation. The strong national economy and presumably improved international economy help to draw down the worldwide stock of copper, thus increasing its

price and improving the profitability of Arizona mines.

Government, F.I.R.E. and T.C.P.U. all grow at modest rates throughout the next four years. The only exception is a slight decline in the communications and public utilities sector in Maricopa County in 1987. This is probably related to cost cutting by utilities.

SUMMARY

The above analysis illustrate two possible alternative paths that the nation's economy might take and the resulting impact on employment in Arizona. Overall, the optimistic simulation results in 30,700 more jobs in Arizona by 1988 than does the recession simulation. Also, there are 21,000 fewer people unemployed in 1988 in the optimistic

simulation. For the most part, employment levels are higher in 1988 in each industry under the optimistic simulation. However, the stronger 1985 and 1988 in the recession simulation did result in the employment levels in services, T.C.P.U., and F.I.R.E. being higher than in the optimistic simulation. As pointed out above, these industries tend to be less cyclical, particularly on the down side. It appears that the two strong years in the recession simulation more than compensated for the two weak years in these three industries. Finally, it should be noted that this article is for illustrative purposes only and is not a forecast of things to come. See the March issue of this NEWSLETTER for the DES employment and unemployment projections.

David Sinclair

TABLE I
RECESSION SIMULATION

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Real GNP Growth Rate	4.60	1.10	1.40	4.40
Average Prime Rate	11.18	14.57	13.01	12.41
U.S. Housing Starts (millions)	1.87	1.40	1.79	1.98
U.S. Unemployment Rate	6.90	7.30	8.20	7.80
U.S. Car Sales (millions)	11.40	10.20	9.40	10.00
Inflation Rate (CPI)	3.80	5.10	5.00	5.40

OPTIMISTIC SIMULATION

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Real GNP Growth Rate	4.20	3.80	4.00	3.50
Average Prime Rate	9.80	8.90	9.20	8.80
U.S. Housing Starts (millions)	1.82	2.01	2.08	2.08
U.S. Unemployment Rate	7.00	6.80	6.60	6.40
U.S. Car Sales (millions)	11.00	11.20	11.50	11.60
Inflation Rate (CPI)	3.10	3.30	3.80	4.90

TABLE II
ARIZONA
RECESSION SIMULATION
(annual averages, in thousands)

	<u>1984</u>	<u>1985</u>	<u>PERCENT CHANGE</u>	<u>1986</u>	<u>PERCENT CHANGE</u>	<u>1987</u>	<u>PERCENT CHANGE</u>	<u>1988</u>	<u>PERCENT CHANGE</u>
Labor Force	1432.0	1517.4	6.0	1565.2	3.1	1577.2	0.7	1629.2	3.2
Unemployment	71.0	87.6	23.4	116.8	33.2	118.4	1.3	89.9	-24.0
Employment	1361.0	1429.8	5.1	1448.5	1.3	1458.9	0.7	1539.3	5.5
Unemployment Rate	5.0%	5.7%		7.4%		7.5%		5.5%	
Wage and Salary Employment	1180.8	1253.2	6.1	1268.5	1.2	1277.4	0.7	1348.9	5.6
Manufacturing	172.3	188.5	9.4	191.8	1.7	189.6	-1.1	208.0	9.7
Mining	13.3	13.6	2.3	14.2	4.6	10.7	-24.5	12.3	14.8
Construction	96.2	103.9	8.0	99.2	-4.5	101.9	2.7	113.0	10.8
TCPU	60.4	63.5	5.1	66.0	3.9	65.8	-0.3	66.9	1.7
Trade	286.7	307.0	7.1	312.6	1.8	311.8	-0.2	326.9	4.8
Fire	71.7	74.6	4.0	75.7	1.4	78.0	3.1	81.8	4.8
Services	274.1	292.3	6.6	298.8	2.2	308.0	3.0	326.1	5.8
Government	206.1	209.9	1.8	210.2	0.1	211.5	0.5	213.8	1.0

NOTE: Annual averages may not add due to rounding. Percent changes are calculated using unrounded figures.

TABLE III
ARIZONA
OPTIMISTIC SIMULATION
(annual averages, in thousands)

	<u>1984</u>	<u>1985</u>	<u>PERCENT CHANGE</u>	<u>1986</u>	<u>PERCENT CHANGE</u>	<u>1987</u>	<u>PERCENT CHANGE</u>	<u>1988</u>	<u>PERCENT CHANGE</u>
Labor Force	1432.0	1513.1	5.7	1569.9	3.7	1600.0	1.9	1638.9	2.4
Unemployment	71.0	90.4	27.3	97.2	7.5	81.9	-15.7	68.8	-15.9
Employment	1361.0	1422.7	4.5	1472.7	3.5	1518.1	3.0	1570.0	3.4
Unemployment Rate	5.0%	5.9%		6.1%		5.1%		4.2%	
Wage and Salary Employment	1180.8	1246.7	5.6	1290.7	3.5	1330.4	3.0	1376.3	3.4
Manufacturing	172.3	186.6	8.3	196.8	5.4	204.1	3.7	214.7	5.1
Mining	13.3	13.2	-0.8	14.2	7.9	15.0	5.1	15.1	0.8
Construction	96.2	102.1	6.1	107.9	5.6	112.3	4.1	116.5	3.7
TCPU	60.4	63.1	4.4	64.4	2.0	64.3	-0.2	64.9	0.9
Trade	286.7	306.1	6.8	316.5	3.3	327.2	3.3	342.0	4.5
Fire	71.7	74.1	3.3	75.5	2.0	78.1	3.4	80.9	3.4
Services	274.1	291.6	6.4	304.0	4.2	314.8	3.5	325.4	3.3
Government	206.1	209.9	1.8	211.4	0.6	214.6	1.5	216.8	1.0

NOTE: Annual averages may not add due to rounding. Percent changes are calculated using unrounded figures.

NEW DEVELOPMENTS

"New Developments" is featured each month as a service to employers and job seekers. It is a compilation of public announcements of the more significant new construction, grand openings, major hirings and layoffs, and other employer events that have special significance for Arizona labor markets. The announcements are paraphrased and otherwise edited from articles published in newspapers and other periodicals from throughout the state. "New Developments" are limited to space available, and no attempt is made to compile an exhaustive list of all such events that have occurred during the month.

CONSTRUCTION - Phoenix could become home to the tallest building in the world if international businessman George Schriqui gets his way. His plan is for a 114-story, 1,692 foot tower taking in eight blocks bounded by Central and Third Street, and Moreland and Garfield Streets. The building would be 238 feet taller than the Chicago Sears Tower and triple the number of stories of the Valley Bank Center downtown, which is now Phoenix's tallest building. Inside the tower would be 2.8 million square feet of space: 15 levels of townhouses and condominiums, 23 levels with 480 hotel rooms, two levels of restaurants, two levels of retail shops, and 72 levels of offices. Schriqui says he picked Phoenix because it was in its "takeoff" phase and that his discussions (of the height) with city and community leaders as well as European investors told him that, "they need that drama--they are looking for a kind of identity." City and state officials already have agreed to spend \$58,000 to study whether special access can be provided from Central to the freeway, and aviation officials will have to grant a height waiver for the building to go ahead.

Ground was broken May 6 on a \$20 million jai alai complex to be located on the northern edge of the Gila River Indian Reservation. Jai alai competition, which somewhat resembles handball, will bring the first pari-mutual betting on the sport in Arizona and with it some \$7 million or more annually to the Gila River Community. The facility is expected to create 500 jobs, a

third of which are guaranteed to the Indian people. C.A.H.R. Inc., which is doing the construction, will also donate \$1 million a year from a 1 percent tax to a special fund for educational and health needs on the reservation. Arizona Attorney General Robert Corbin, however, feels that jai alai betting violates the state criminal code and also that organized crime could become involved. He says, "Las Vegas can't control it. Atlantic City can't control it. What makes the Indians think they can control it?" Mr. Corbin says he will file suit in federal court to shut the games if gambling is allowed. The complex is due to open in October 1986.

Tempe's planned "Corporate Lakes" project has been expanded from a \$400 million project to a \$735 million project which will include a major shopping mall, apartments, and condominiums. The revised plan will expand the original 3.6 million square-foot complex to 5.6 million square feet, with 1 million square feet of additional space devoted to residential housing. Tom Baker, senior vice president for the Wolfswinkel Group of Mesa, the developer, said "We're talking about doing a major retail complex like the Biltmore Fashion Park." The development will be situated on 133 acres bounded by Baseline Road, the Superstition Freeway, Interstate 10, and Priest Drive. The mall will front Baseline Road and have a lake system behind it.

Office space in Tucson is now about 4 million square feet with a vacancy rate of 19.5 percent. However, once all the commercial buildings now being built or planned are completed, office space will increase about 50 percent to 6 million square feet. This is according to a survey conducted by the Del E. Webb Realty and Management Company. The survey showed that 43 office buildings are being built or are in the planning stage. The average size of these new buildings is 43,500 square feet, substantially more than the 32,000 square-foot average of the area's 127 existing office buildings. The building activity is spread throughout several areas: the northwest side, the east side, and the far west

side of Tucson will get 500,000 to 548,000 square feet each. The remainder of the projected 2 million square-foot increase will go to the central and downtown areas.

The Phoenix Civic Plaza has spent \$40 million on its expansion that began in 1982 and the results will be seen on June 1, when the new plaza opens. The addition includes a 28,000 square-foot ballroom, 300,000 square feet of exhibit space, and 43 meeting rooms. Also expanded were the kitchen facilities which will now have a feeding capacity of 10,000 people. Dennis Maus, Civic Plaza director says that, due to the expansion, the Plaza will be able to bid for and handle "98 percent of the conventions being held in the country today."

Arizona Futures Corporation is hoping to get a long-term ground lease on an 800-acre parcel of state-owned land in northeast Scottsdale. The land will go up for auction at the end of the year, and Arizona Futures Corporation hopes to be able to use it for a "Scottsdale Futures Park" which is expected to employ some 25,000 people. The park would provide businesses with centralized computer facilities and messenger and financial services. A "New Ventures Incubator Center" would provide managerial support and venture capital to new companies. At a "National Center for Aging Well" researchers would focus on how to stay healthy while living longer. The employees themselves would be surrounded by high-tech amenities, including a teleconferencing center, a minibus, and a helicopter shuttle system. The project is expected to be completed within five years.

EDUCATION - On June 27 and 28 Vocational Industrial Clubs of America (VICA) will bring 6,000 vocational students and teachers to the Phoenix Civic Plaza. This will be Phoenix's biggest convention of the year and it will inject \$3.2 million into the state's economy, according to Mayor Terry Goddard. Carolyn Warner, state superintendent of public instruction, said that vocational education "is not getting the attention it should" at the national level and that a "surge in that area is long past due." She said 1985 and 1986--the two years

for the Phoenix VICA conventions--"promise to be landmark years for vocational education in Arizona." Mayor Goddard added that the convention will be the first to use the newly completed addition to the Civic Plaza to capacity.

HOTELS & MOTELS - Arizona's lodging industry (motels, hotels, and trailer parks) generated receipts of \$538 million and paid \$150 million to 22,000 employees in 1982, according to the Census of Service Industries conducted by the U.S. Bureau of the Census. Receipts per establishment within the entire lodging industry averaged \$764,000 in 1982 and employment per establishment averaged 31 workers. Employee pay averaged just \$6,800, which indicates the industry's need for part-time and seasonal workers as well as for a large number of unskilled workers. One half of the motels, hotels, and trailer parks were outside the metropolitan areas of Arizona, yet due to their small size, their share of the industry's employment and receipts was only about 25 percent. In contrast, lodging establishments in Maricopa County numbered only about 33 percent of the state total, but they generated 60 percent of total receipts. Copies of this study can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

MINING - Phelps Dodge claims that it is at about "break even" despite hard times that have fallen on the industry since 1982 and a strike that started on July 1, 1983 at the Morenci and Ajo facilities. In fact, Phelps Dodge claims that it came out ahead in the strike and, as far as the weak copper market goes, Leonard Judd, Phelps Dodge's new chief of western mining operations said, "We can take advantage of a strong market, we can hold our own in a weak market -- we think we can hold our own in any case." This optimism comes about despite current copper prices that remain far below the average cost of its production. In fact, Phelps Dodge, the nation's largest independent copper company, is moving to concentrate more on copper and less on other interests while other copper companies are divesting themselves of cop-

per properties. The key to success now, Phelps Dodge says, is for copper inventories to continue dropping enough to drive copper prices back up.

REAL ESTATE - The Phoenix area is attracting even the most conservative investors to its real estate market. Syndicators, real estate investors, pension funds, lending institutions, and individual investors are all attempting to acquire properties in Phoenix. In fact, real estate dollars, which have been traditionally originated locally, as in neighboring California, are now flowing in from all parts of the country. Why? Well, the phenomenon can largely be explained by the area's sound economic and demographic indicators. Over the past decade, Arizona was the fourth fastest growing state in the country with a population increase of almost 40 percent. Arizona ranked fifth nationally in the rate of job growth over the past ten years with an increase of 49 percent. Also, Arizona ranked sixth nationally in the growth rate of personal income over the past decade with an increase of over 218 percent. Maricopa County also had solid growth. Between 1973 and 1983 population in the county increased by 43 percent, and retail sales increased by over 204 percent. Looking at 1984, estimations of the population increase in metro-Phoenix run as high as 90,000. Over 22,000 new apartment units were built in 1984, yet the overall vacancy rate increased only slightly. The basic fuel for all of this growth and the foundation of investor optimism is the employment market. The unemployment rate in the Phoenix area is about 4 percent, which is well below the national average. Also, the recent employment growth rate has been over 8 percent, which is twice the national average. New jobs are being created each of the past two years at a rate of about 65,000 new jobs. More and more firms are opening new facilities, existing firms are expanding, and investors are positioning themselves to get their piece of the expanding pie.

The Phoenix Community Alliance (PCA), comprised of local builders, real estate developers, and other prominent business peo-

ple, has proposed a concept called "Superblock." The Phoenix City Council has endorsed the project, and an urban design firm hired by the Alliance reported that master planning six blocks at a time into one cohesive development is the best way for downtown Phoenix development to begin. The starting point, PCA believes, should focus on the general area between Van Buren and Roosevelt to the north, Central to the west, and Seventh Street to the east. This area would fit into the existing development pattern and encourage walking between the Civic Center, the Symphony Hall, and downtown's major hotels. While the land has not yet been bought by developers, the Alliance is preparing to plan and coordinate both the Superblock and the area surrounding it "for the collective benefit of the community and the collective benefit of the developers."

A study by Coldwell Banker, a real estate company, reported that Phoenix has the lowest industrial-vacancy rate among major cities in the country. That rate dropped to 1.7 percent during the first quarter of 1985 from 3.2 percent in the last quarter of 1984. This was due to a surge in rentals and a slow-down in the construction of large industrial buildings. The national industrial-vacancy rate is 4.8 percent. In contrast, the same study showed that Phoenix also has one of the highest office-space vacancy rates in the U.S. among major cities. Overbuilding is blamed. The downtown area's rate is 20.7 percent and the suburban area's is 24.9 percent. However, another study shows that, although the office-vacancy rate is high in Phoenix, the number of office workers employed here has been growing faster than in any other major city in the country. Colliers International Property Consultants says Phoenix has the highest annual growth rate--4.49 percent--in office employment since the end of 1982. Tom Richardson of Colliers said, "The same factors that helped make Phoenix a popular resort and retirement community are now contributing to the sustained growth of the city." Nationally, office vacancy rates are 15.3 percent for downtown offices and 18.9 percent for suburban offices.



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